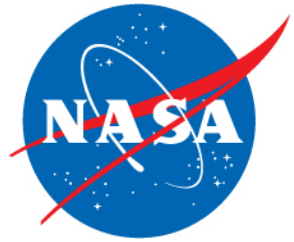
National Aeronautics and Space Administration



Polar winter balloon-borne observations for Aura Validation

Robert Stachnik, James Margitan, Bhaswar Sen, Brian J. Drouin, Jess Landeros[1], Ken Jucks[2], Tim Canty, Ross Salawitch[3]

[1]Jet Propulsion Laboratory , Pasadena CA

[2]Center for Astrophysics, Cambridge MA

[3]University of Maryland, College Park MD

NASA Aura Science and Validation Team Meeting, 2007

Outline

Measurement Goals

- Observations in the cold polar vortex for Aura Validation
- Measurements of gases involved in O_3 depletion

Remote-sensing Emission Payload

Preparations at the Kiruna Esrange (67N, 21E) launch site

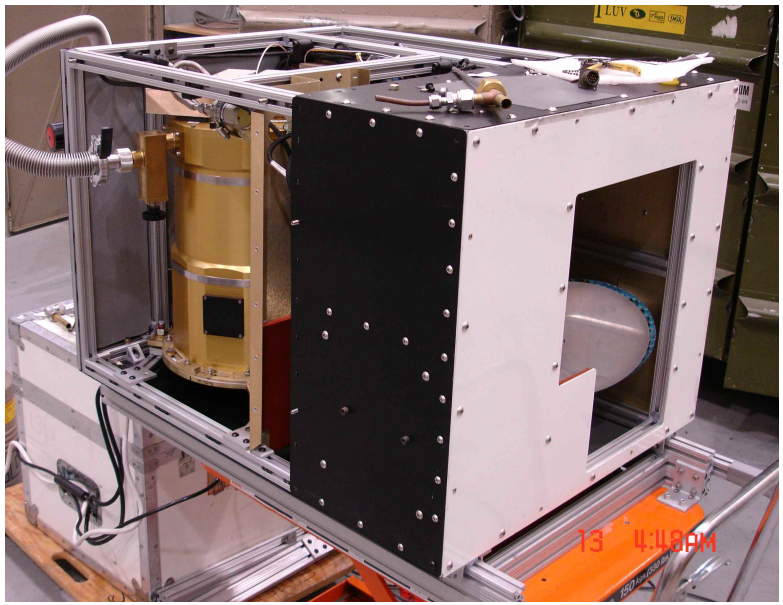
Instruments:

- SLS
- UV-O3
- FIRS-2

Submillimeterwave Limb Sounder (SLS-2)

Instrument overview

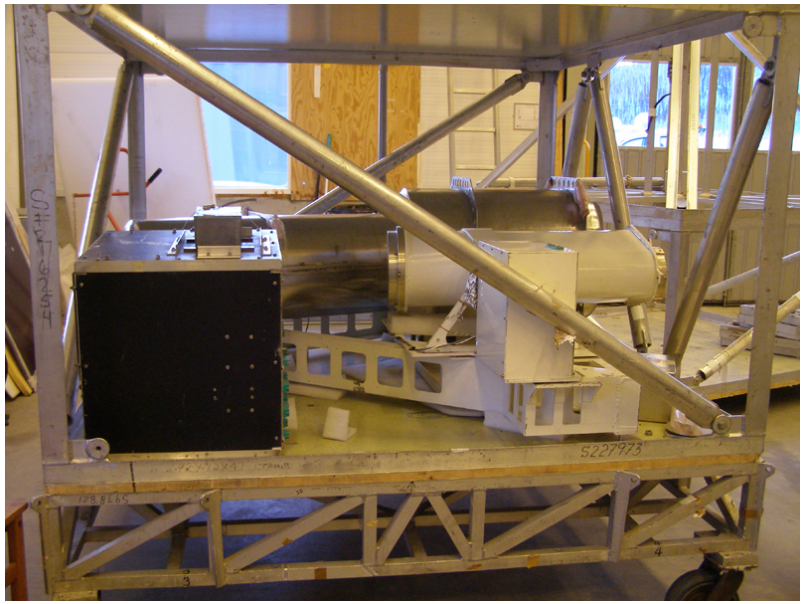
- Balloon-borne frequency tunable SIS heterodyne submillimeterwave radiometer-spectrometer
- Measures limb molecular thermal emission spectra in selected bands from 600 GHz to 700 GHz
- Key measurements: ClO, O_3, HCl, HO_2, HOCl, ...



Far-Infrared Fourier Transform Spectrometer FIRS-2

Ken Jucks, CFA-SAO

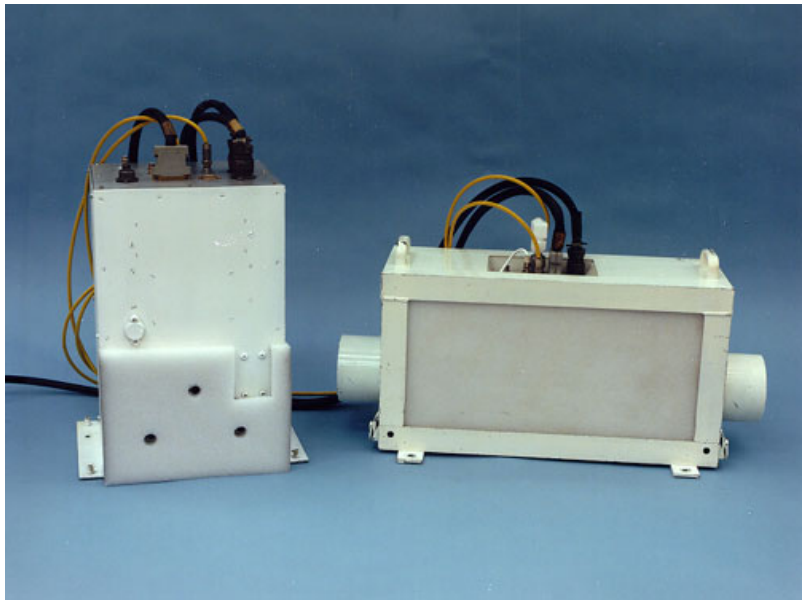
- The FIRS-2 is an FTS operating in the far- (80-340 cm-1) and mid-infrared (330-1220 cm-1).
- Measures limb molecular thermal emission spectra
- Key measurements: OH, H_2O, O_3, HCl, HO_2, H_2O_2, HOCl, HNO_3, N_2O...



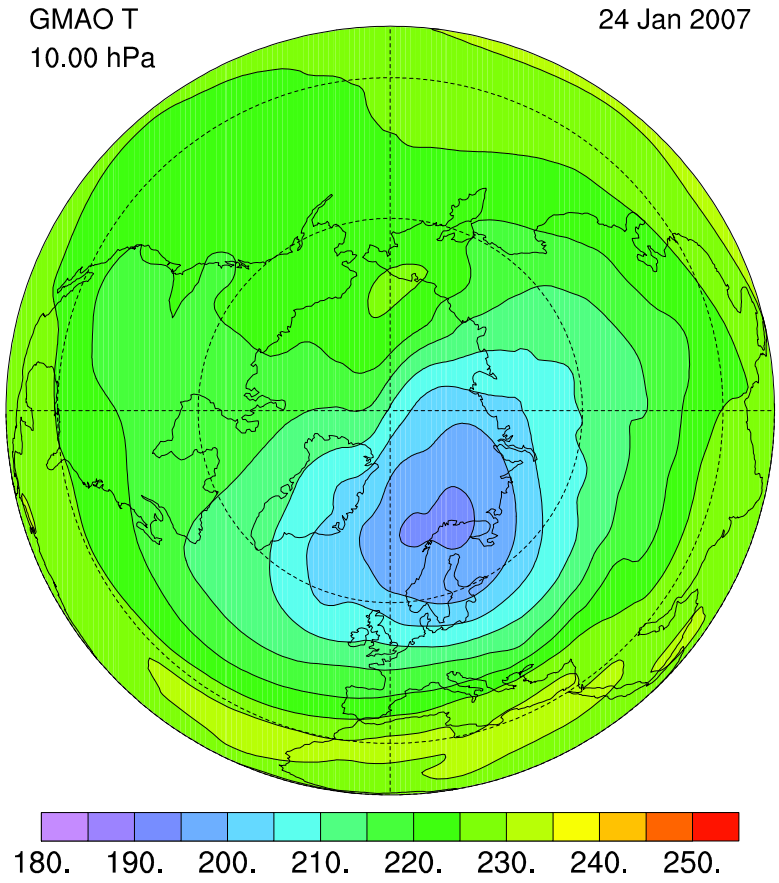
Dual-beam UV-Absorption Ozone Photometer

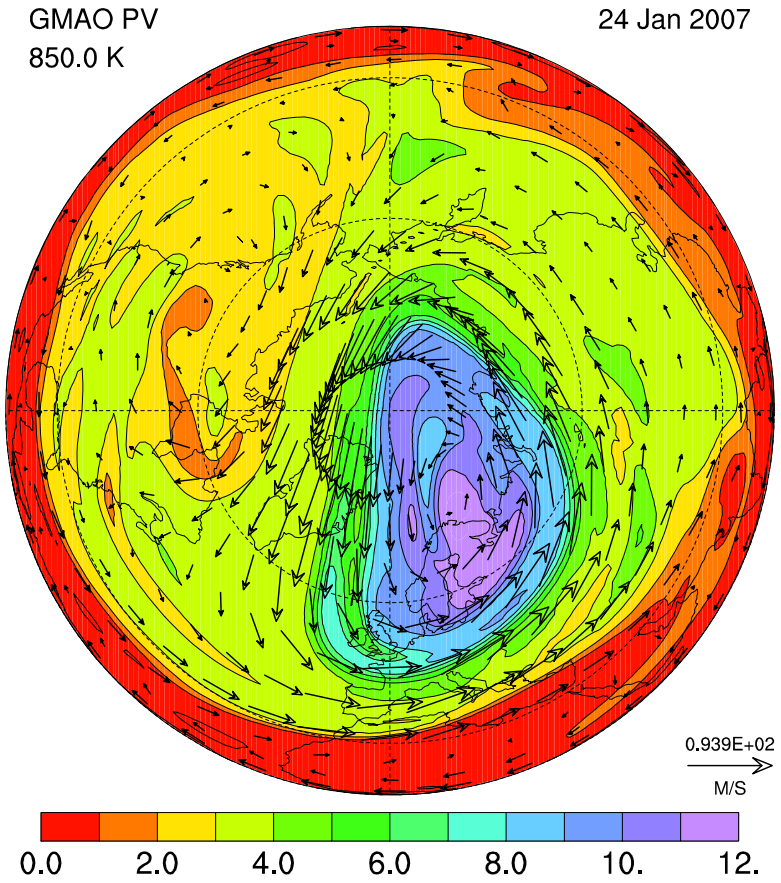
James Margitan, Bhaswar Sen JPL

- In-situ sensor
- High spatial resolution and accuracy (3%) O_3 measurements
- 1 second response time

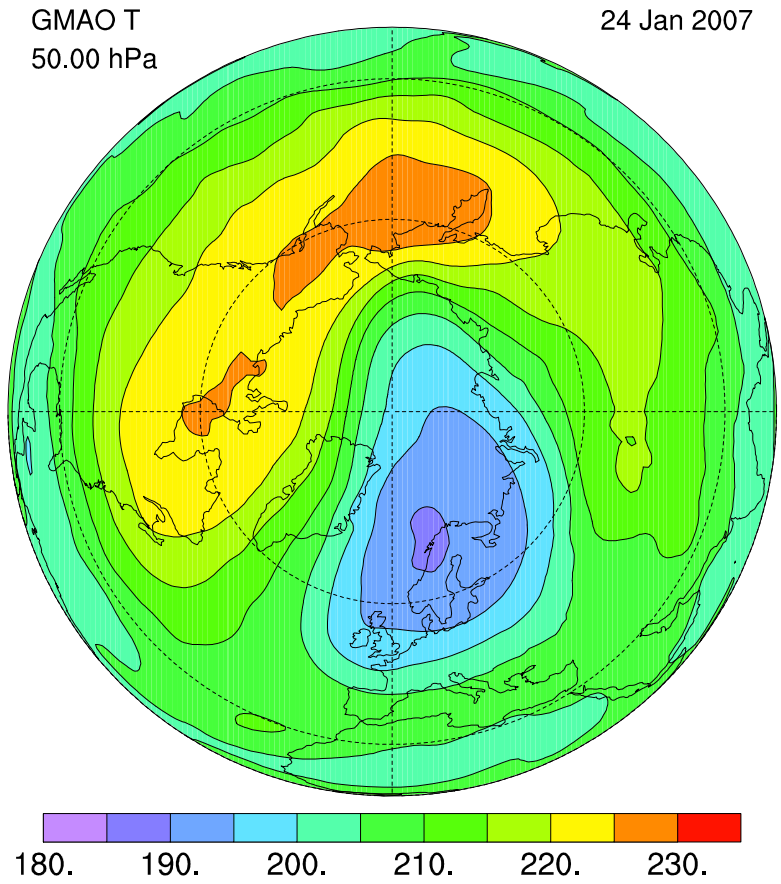


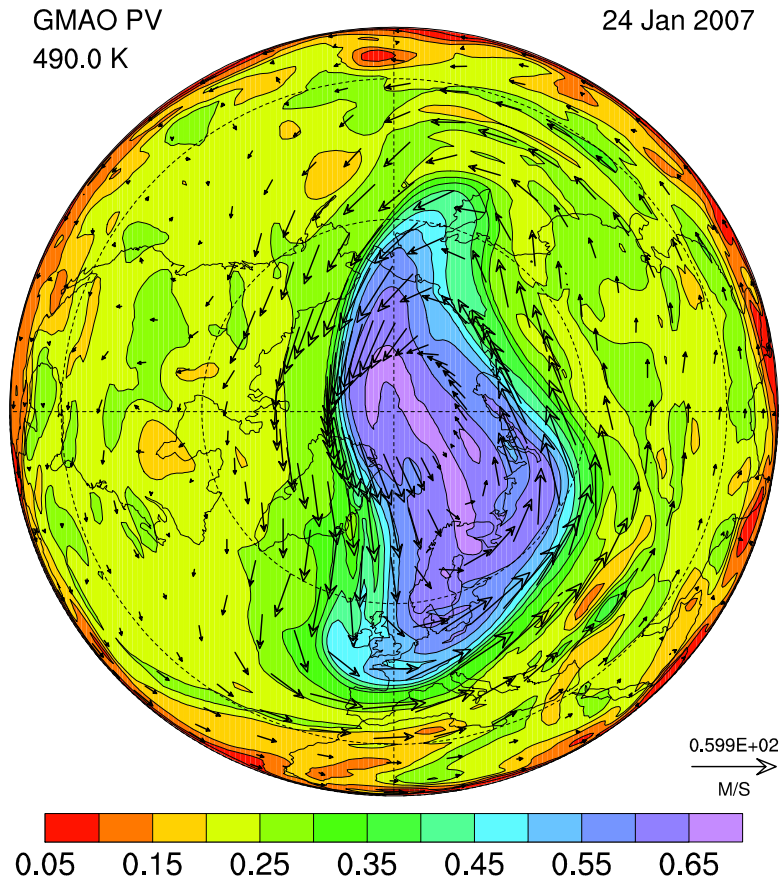
T and PV at balloon float height 10hPa 850K



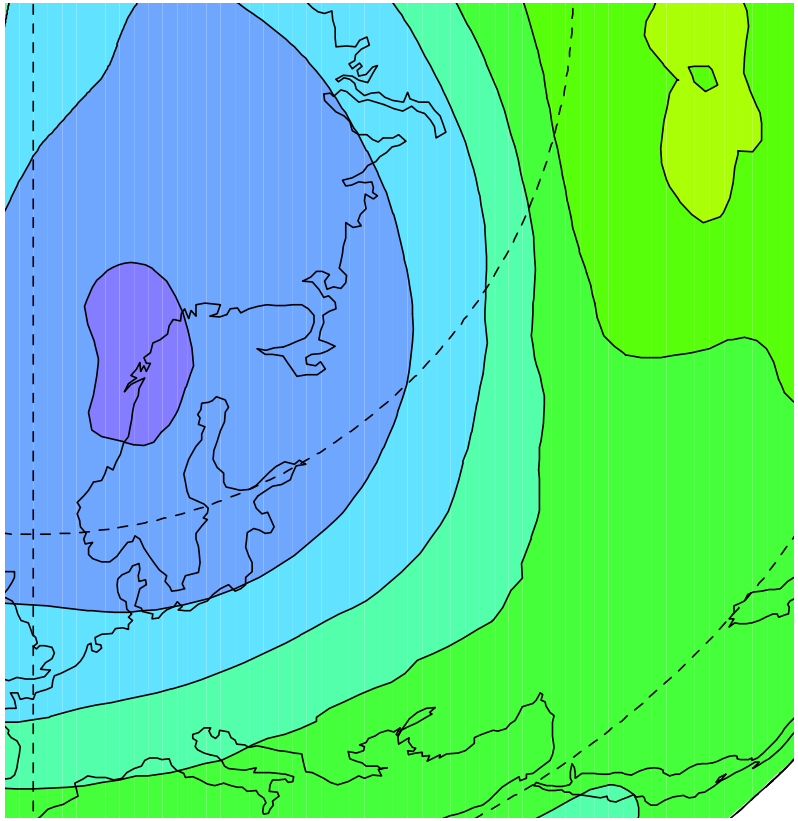


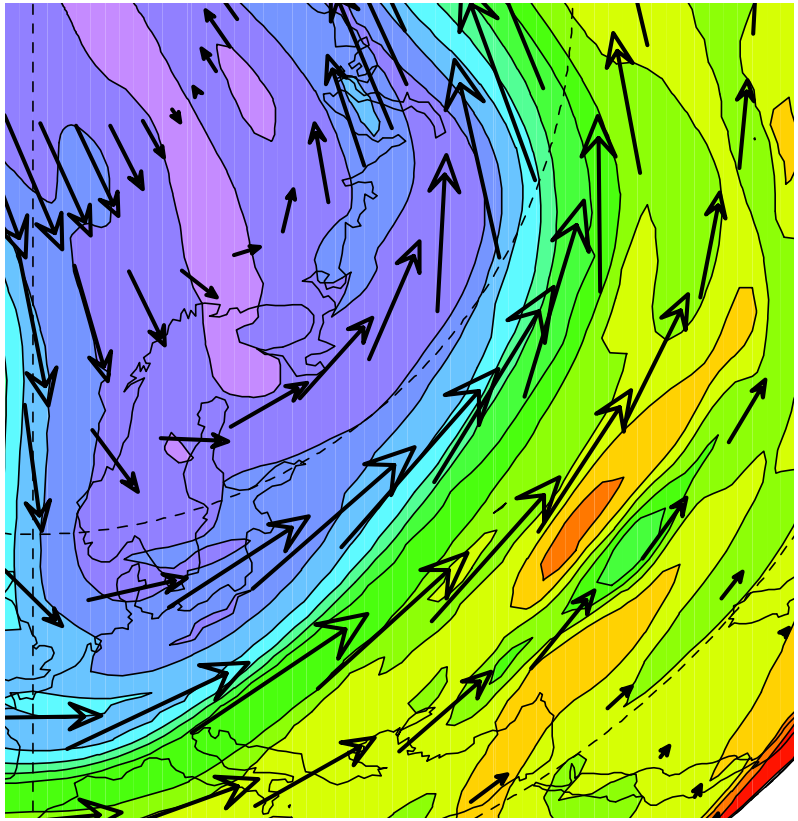
T and PV in the lower stratosphere 50hPa 490K





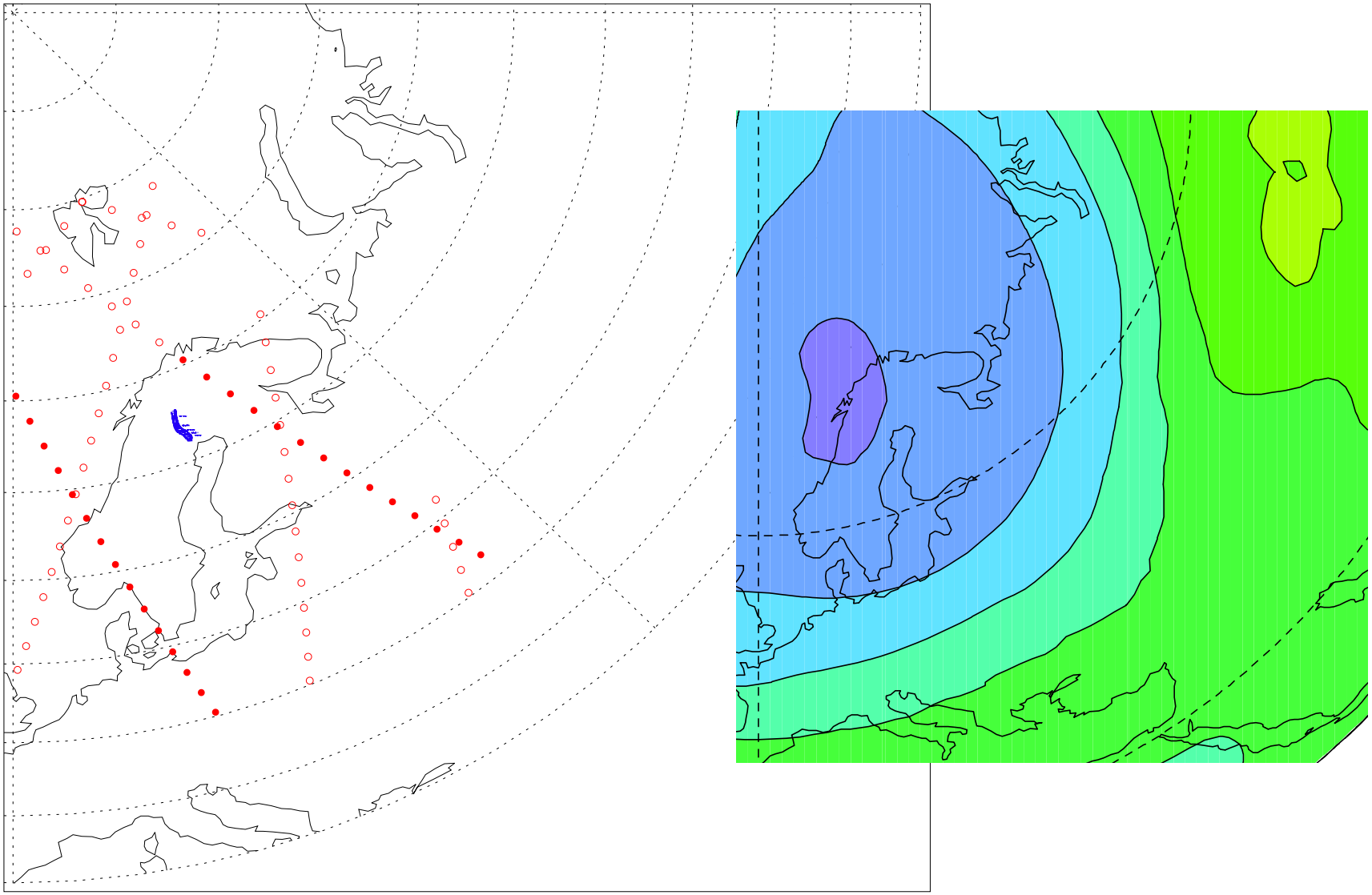
T and PV in the lower stratosphere 50hPa 490K; Kiruna





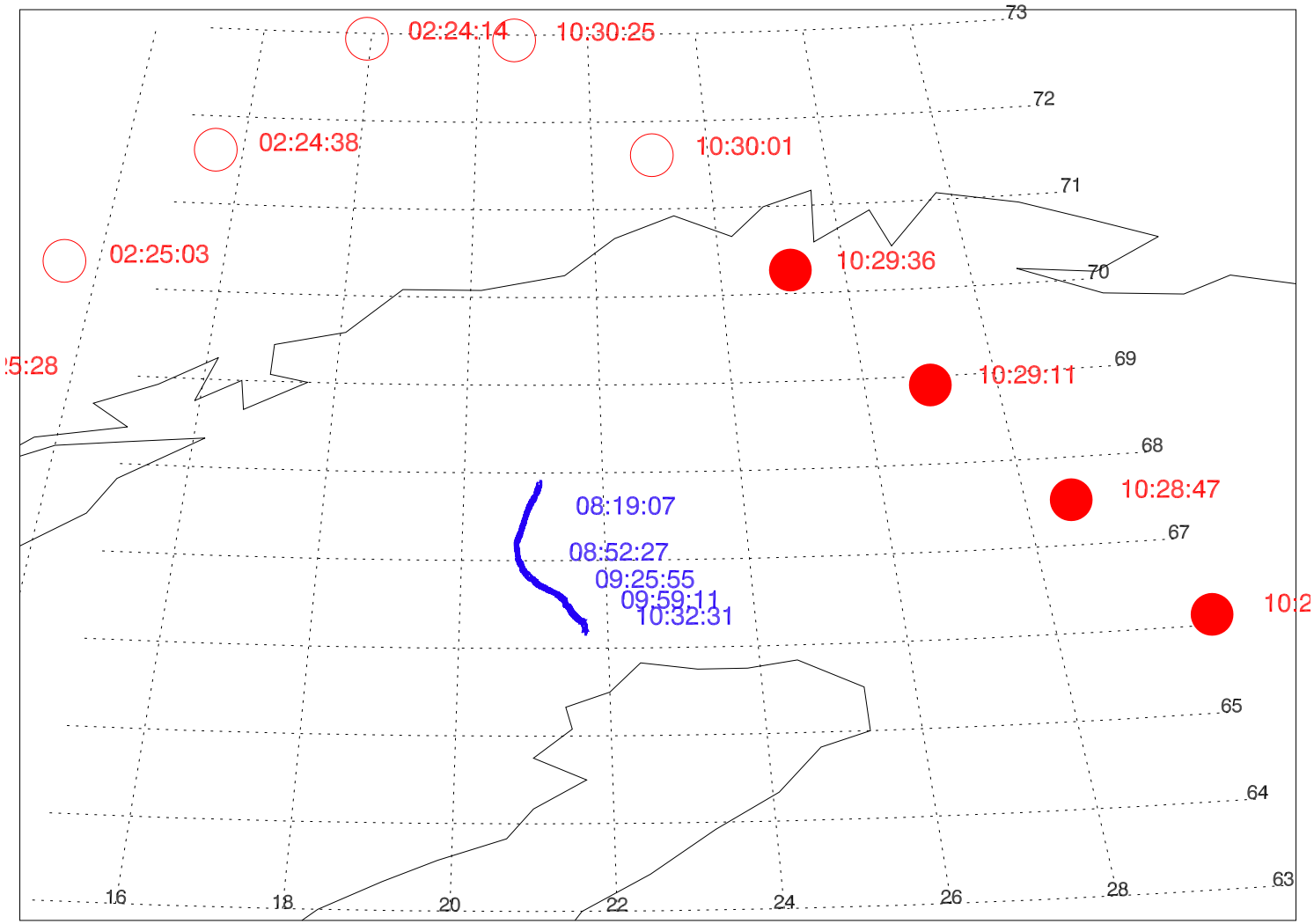
Flight Trajectory

24 January 2007 50 hPa temperature

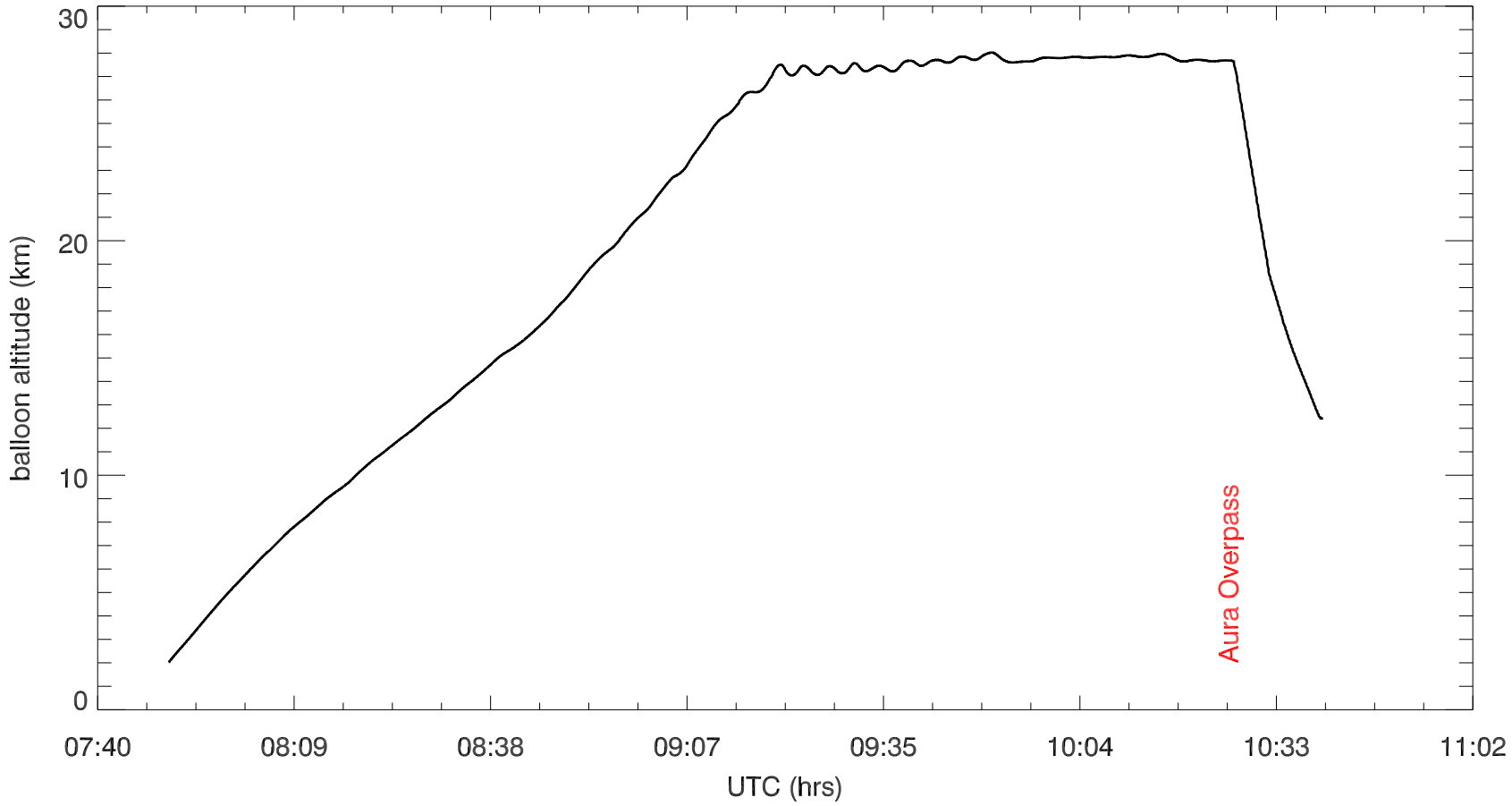


Flight Trajectory

24 January 2007



Balloon altitude



Gondola on launch vehicle

Balloon on ascent

Balloon after release

Gondola at landing site

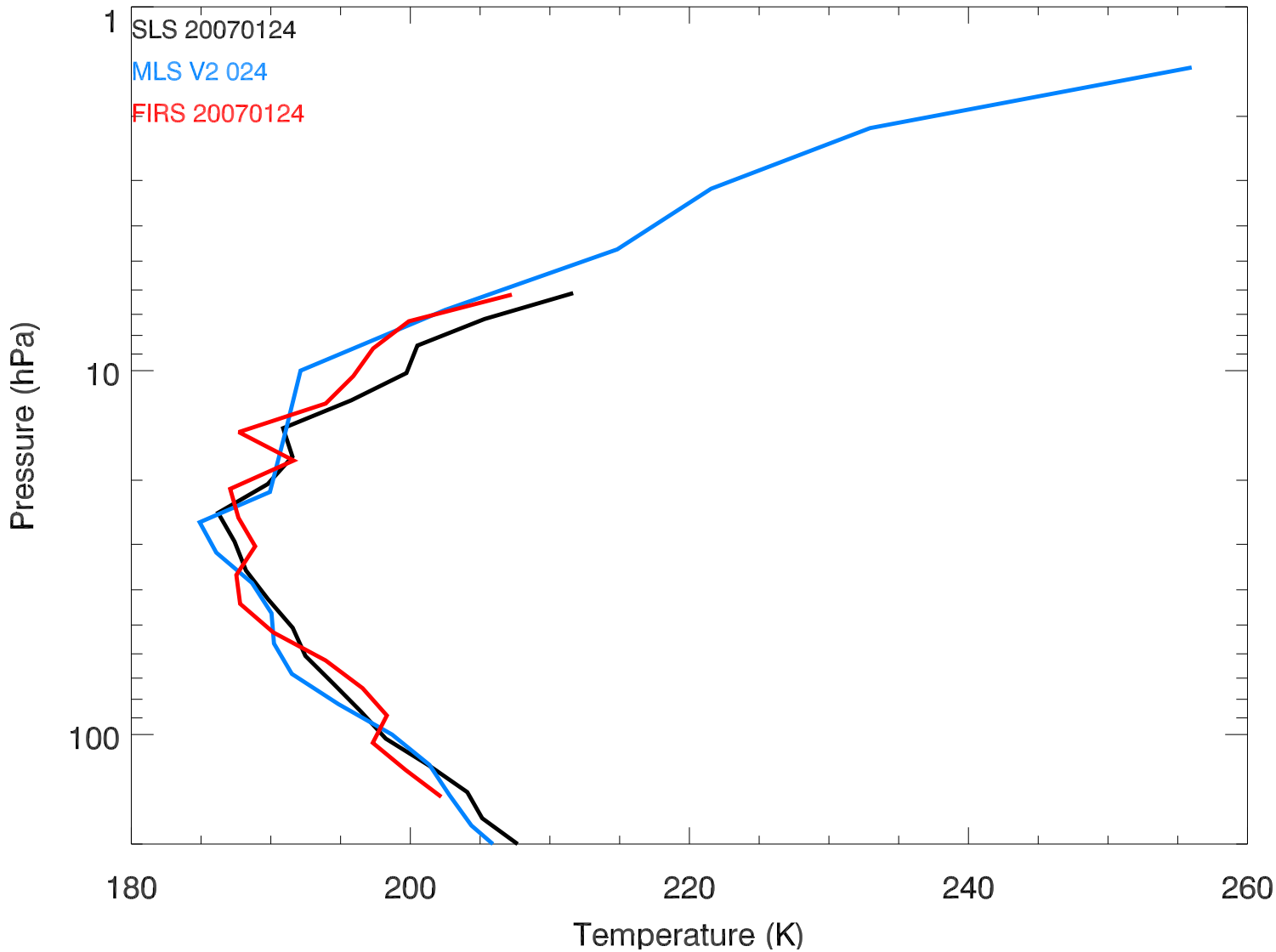
Landing site in trees

Gondola at landing site

Gondola, trees removed

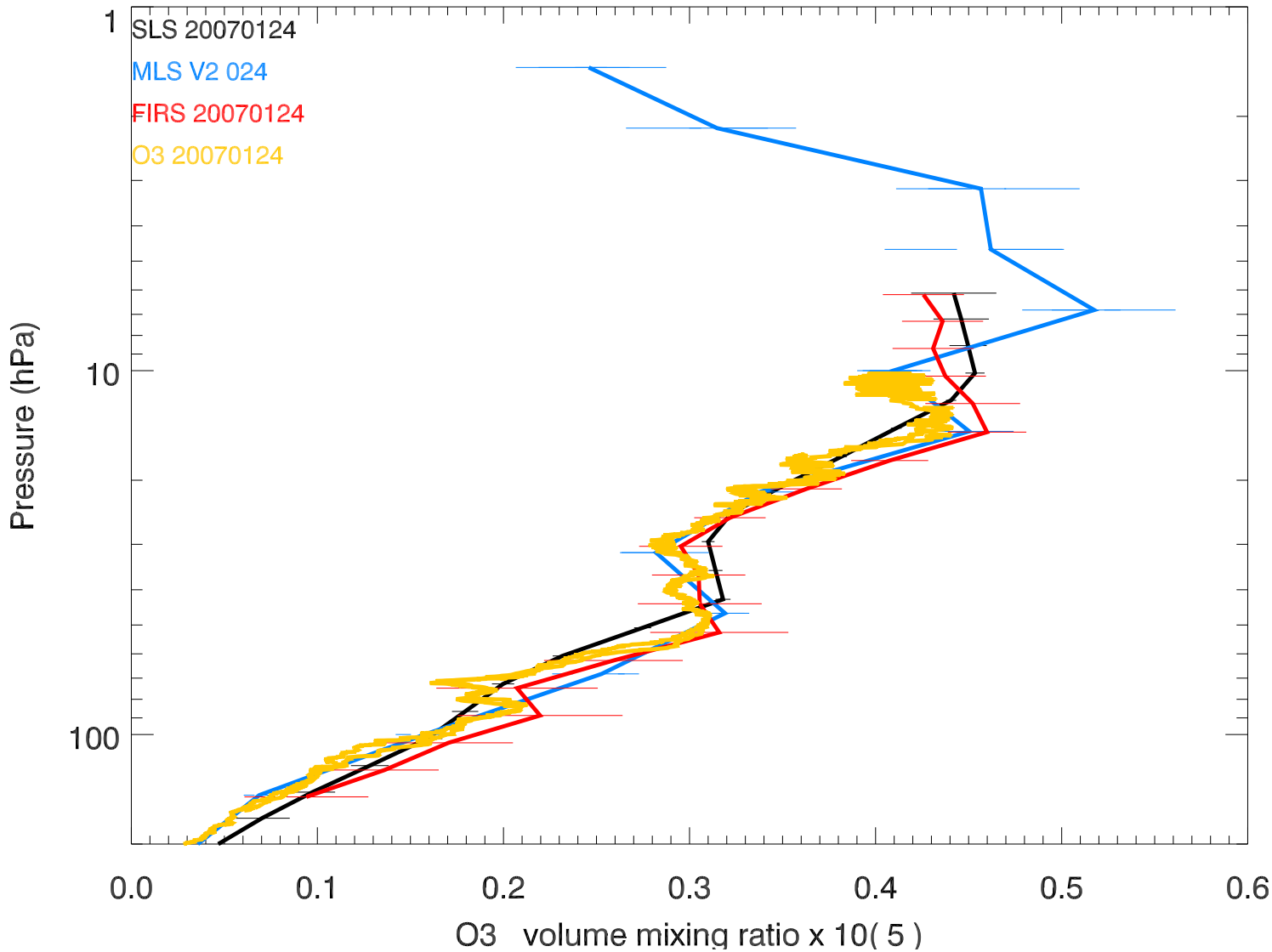
Temperature Intercomparison [averaged profiles]

SLS20070124 MLSV2024 FIRS20070124



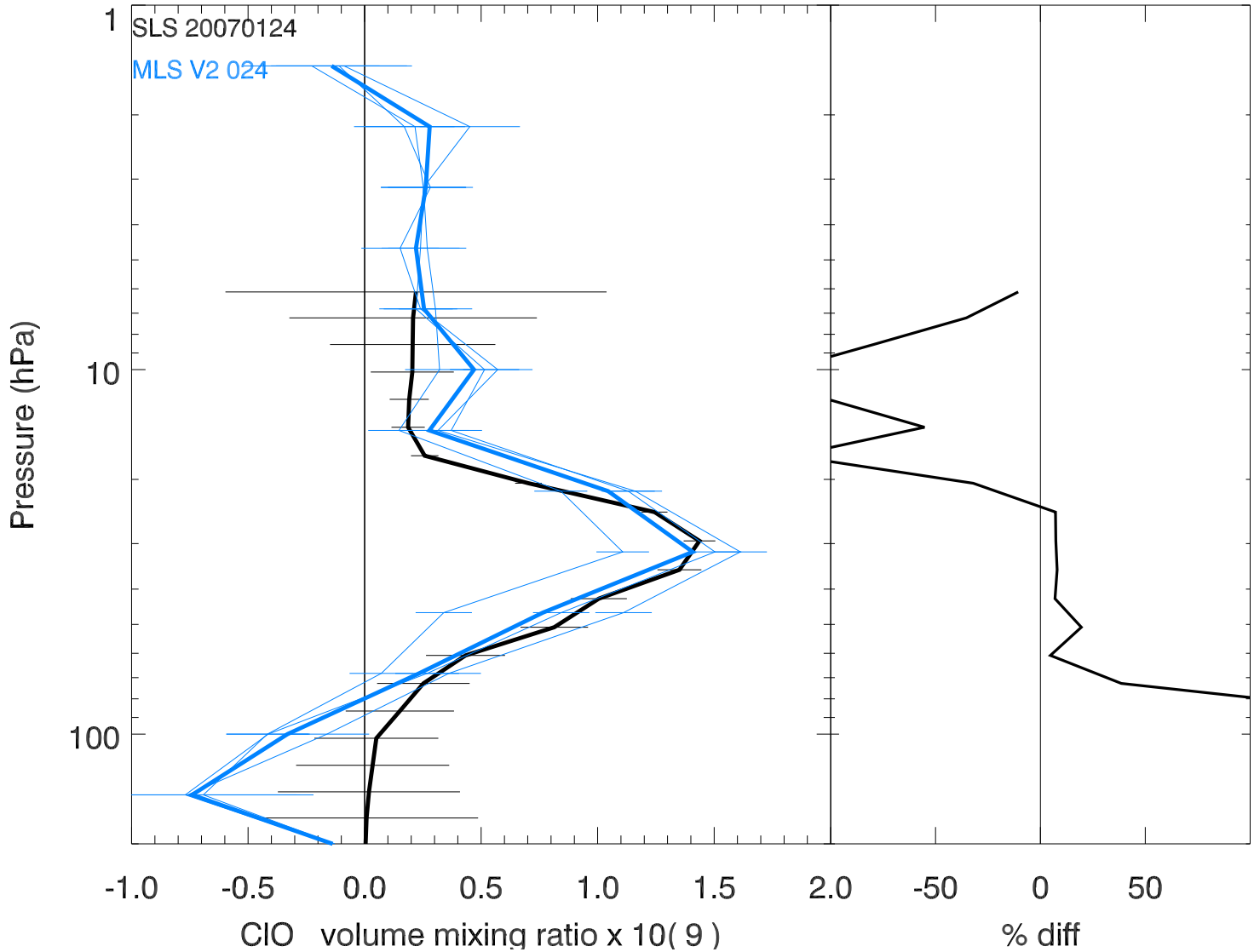
O3 Comparison

SLS20070124 MLSV2024 FIRS20070124 O320070124



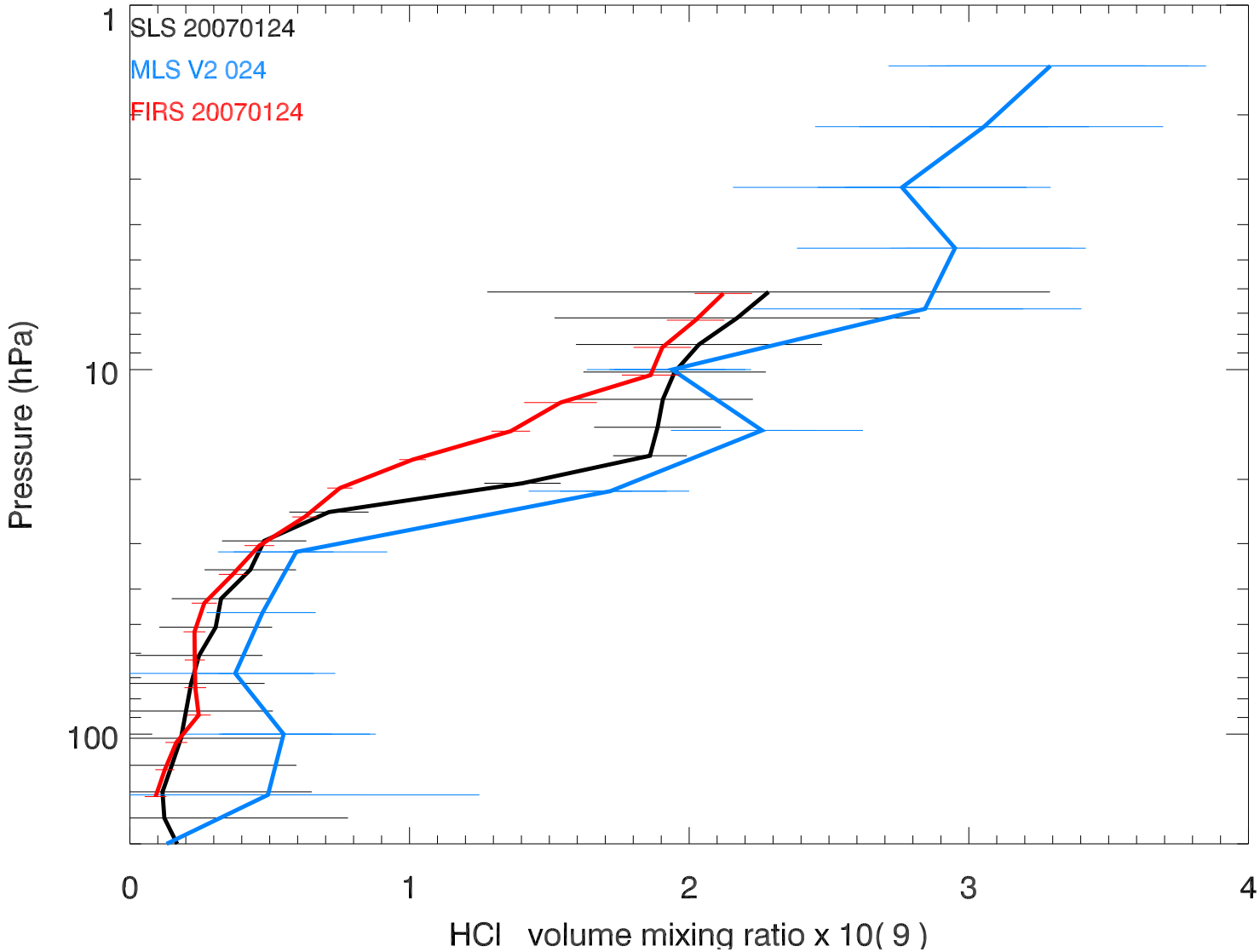
ClO Comparison

SLS20070124 MLSV2024

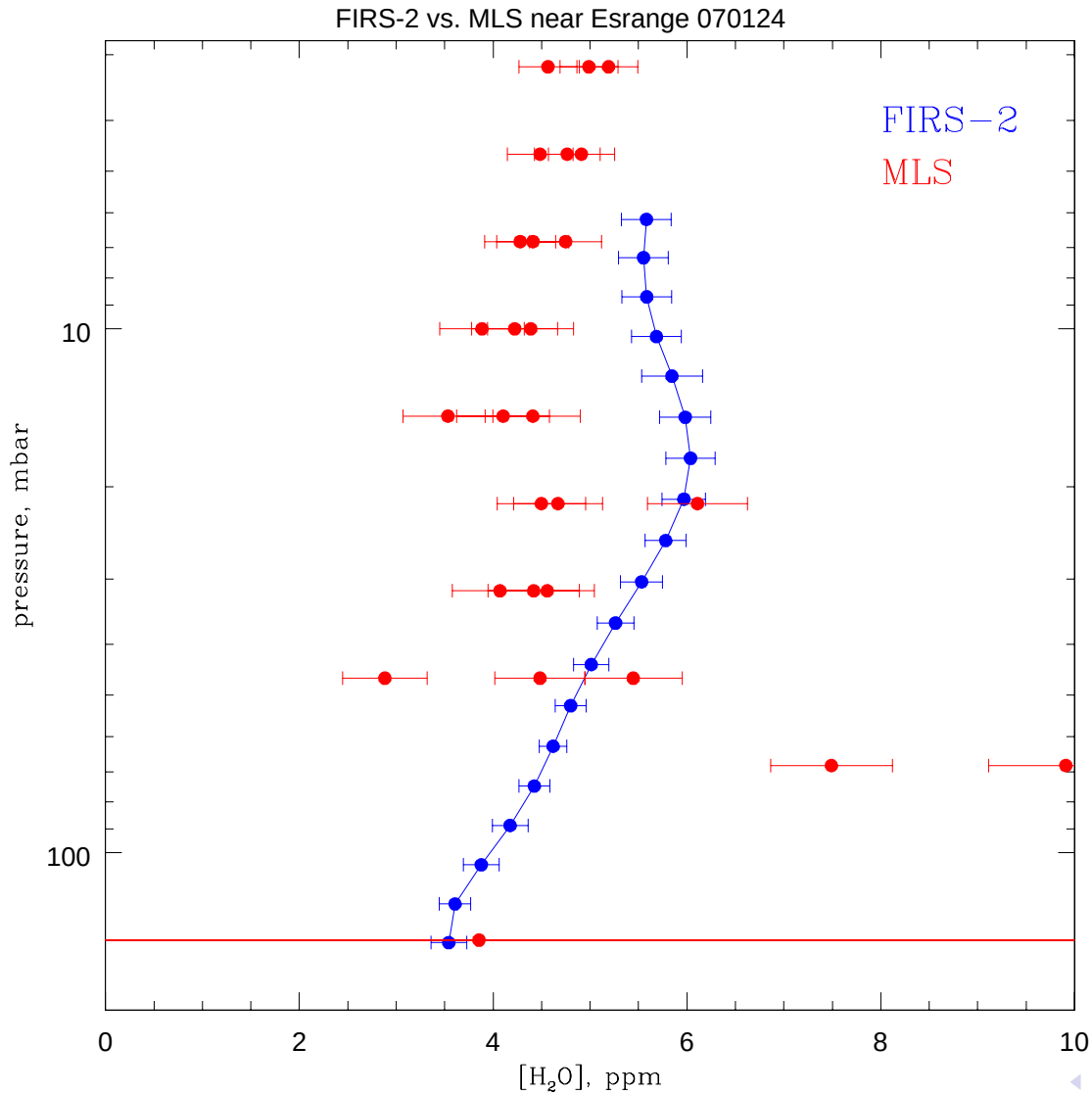


HCl Comparison

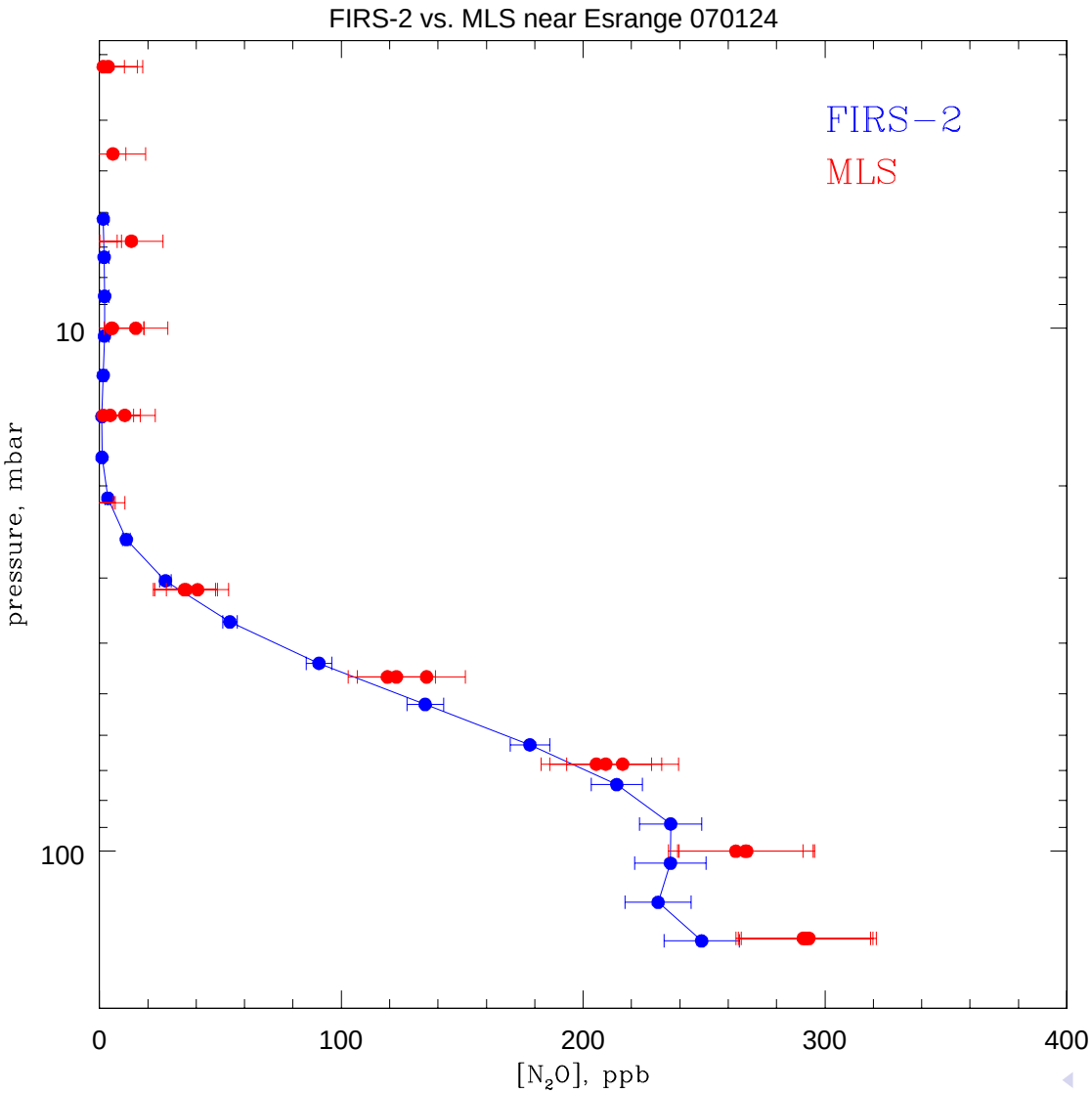
SLS20070124 MLSV2024 FIRS20070124



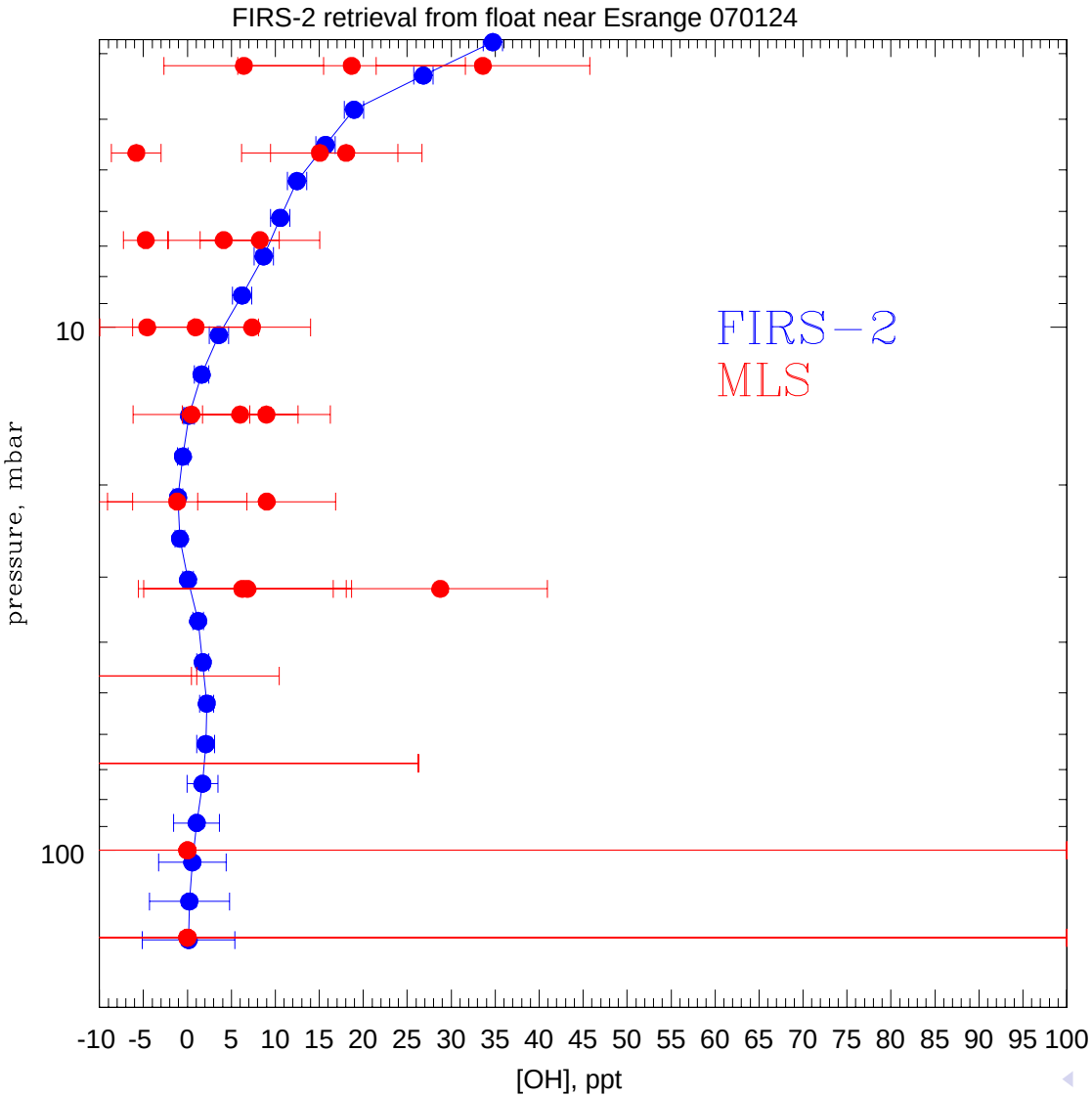
H_2O profile comparison: MLS-FIRS2



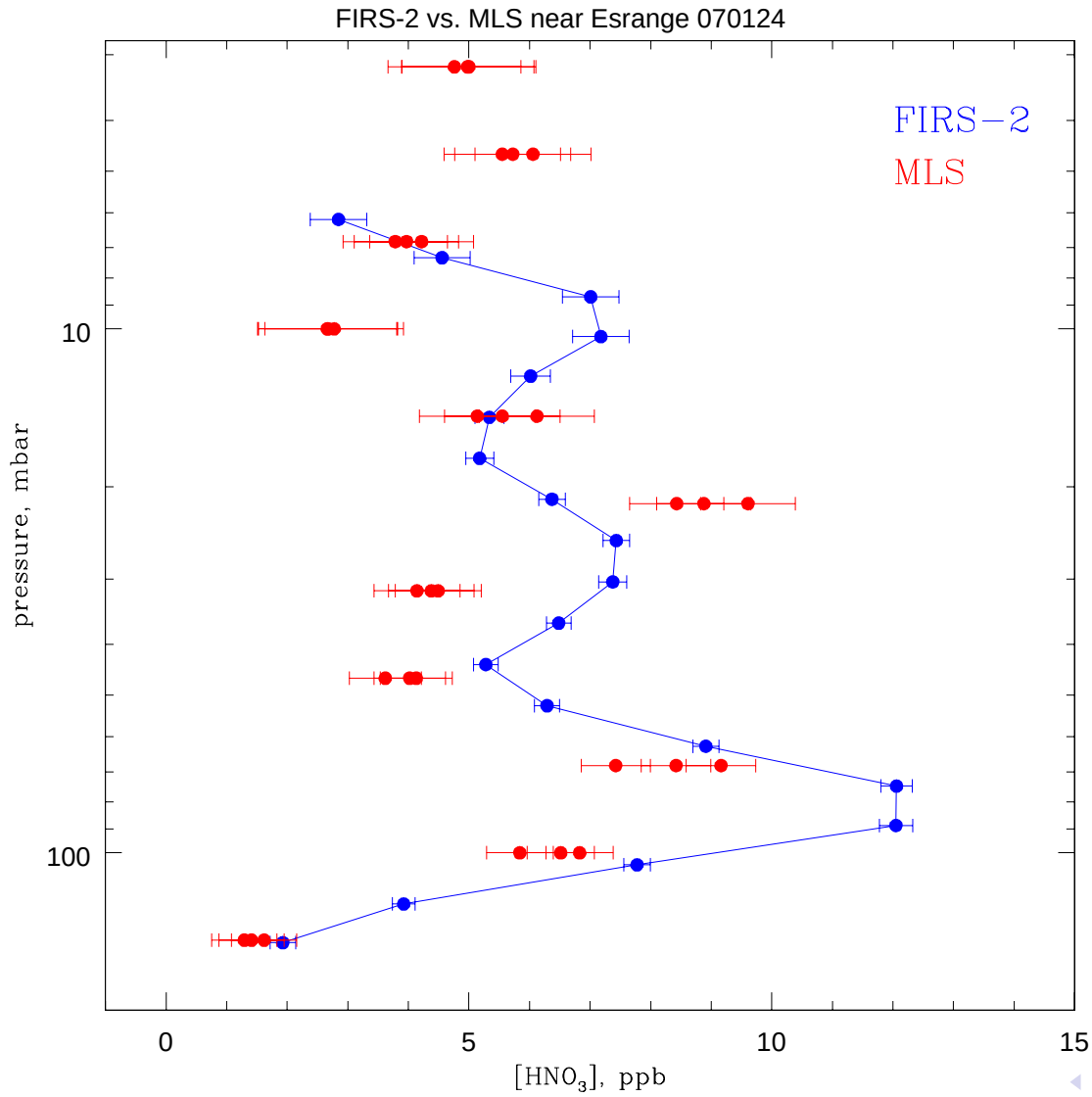
N_2O profile comparison: MLS-FIRS2



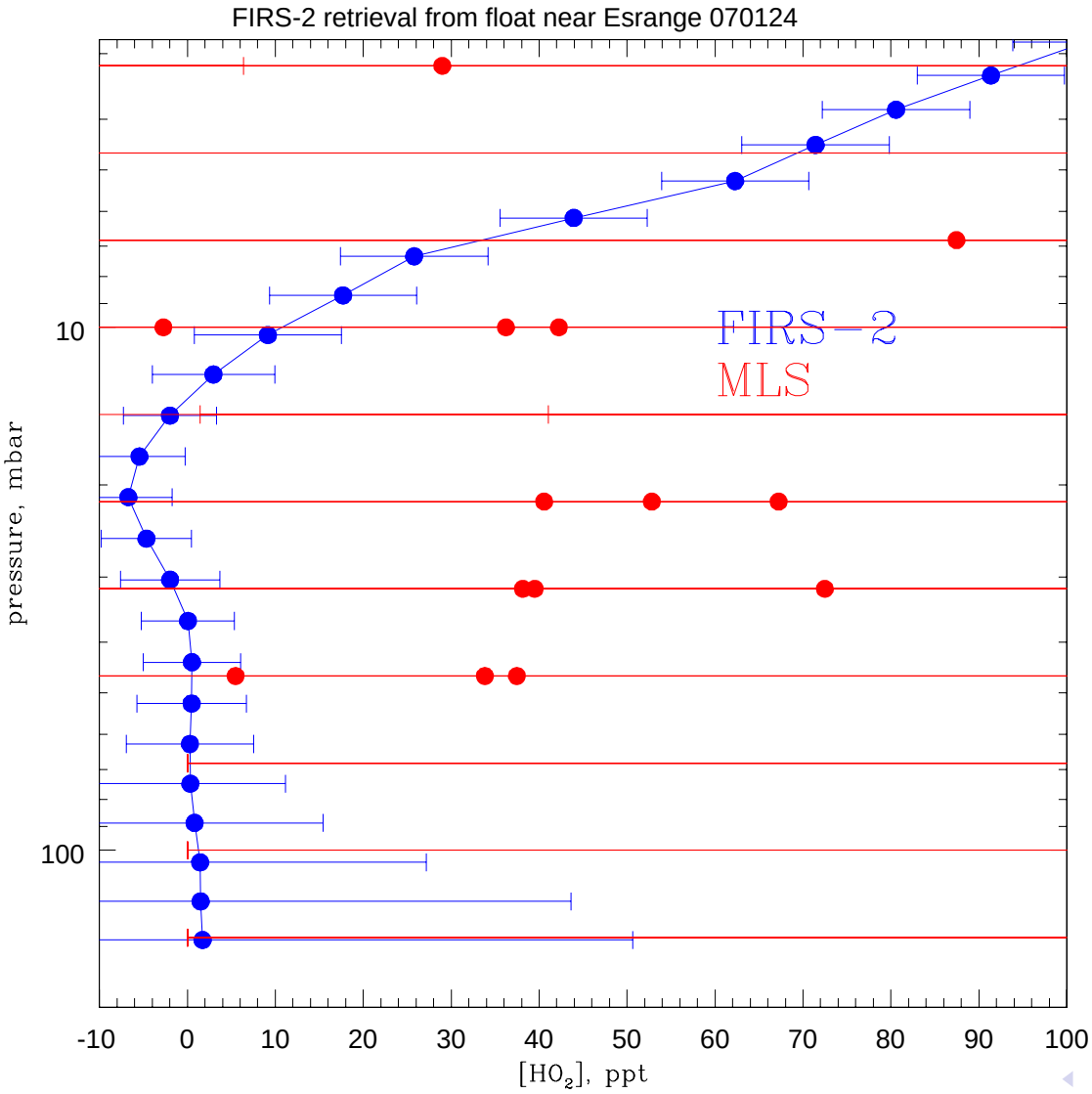
OH profile comparison: MLS-FIRS2



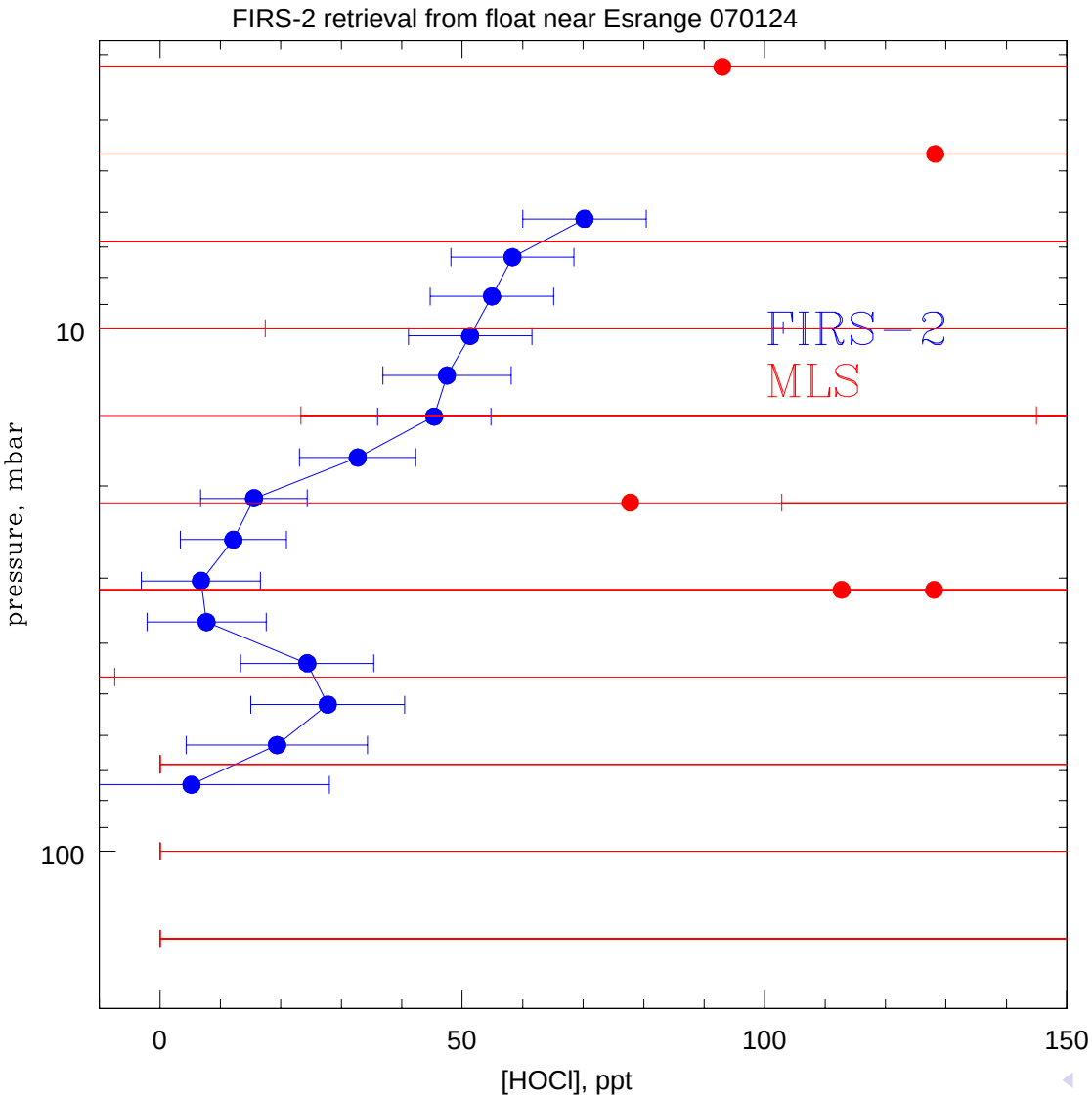
HNO_3 profile comparison: MLS-FIRS2



HO_2 profile comparison: MLS-FIRS2

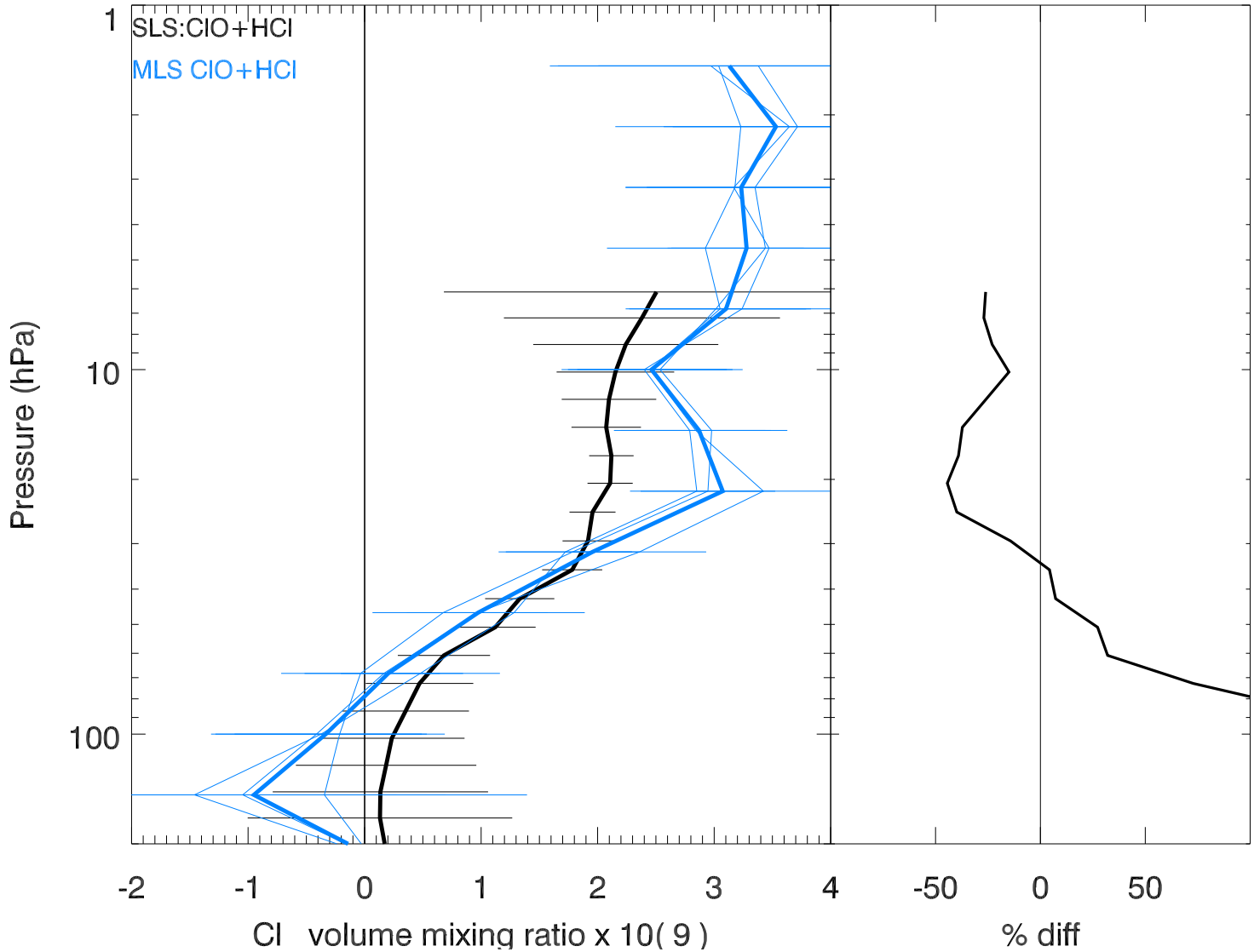


HOCl profile comparison: MLS-FIRS2



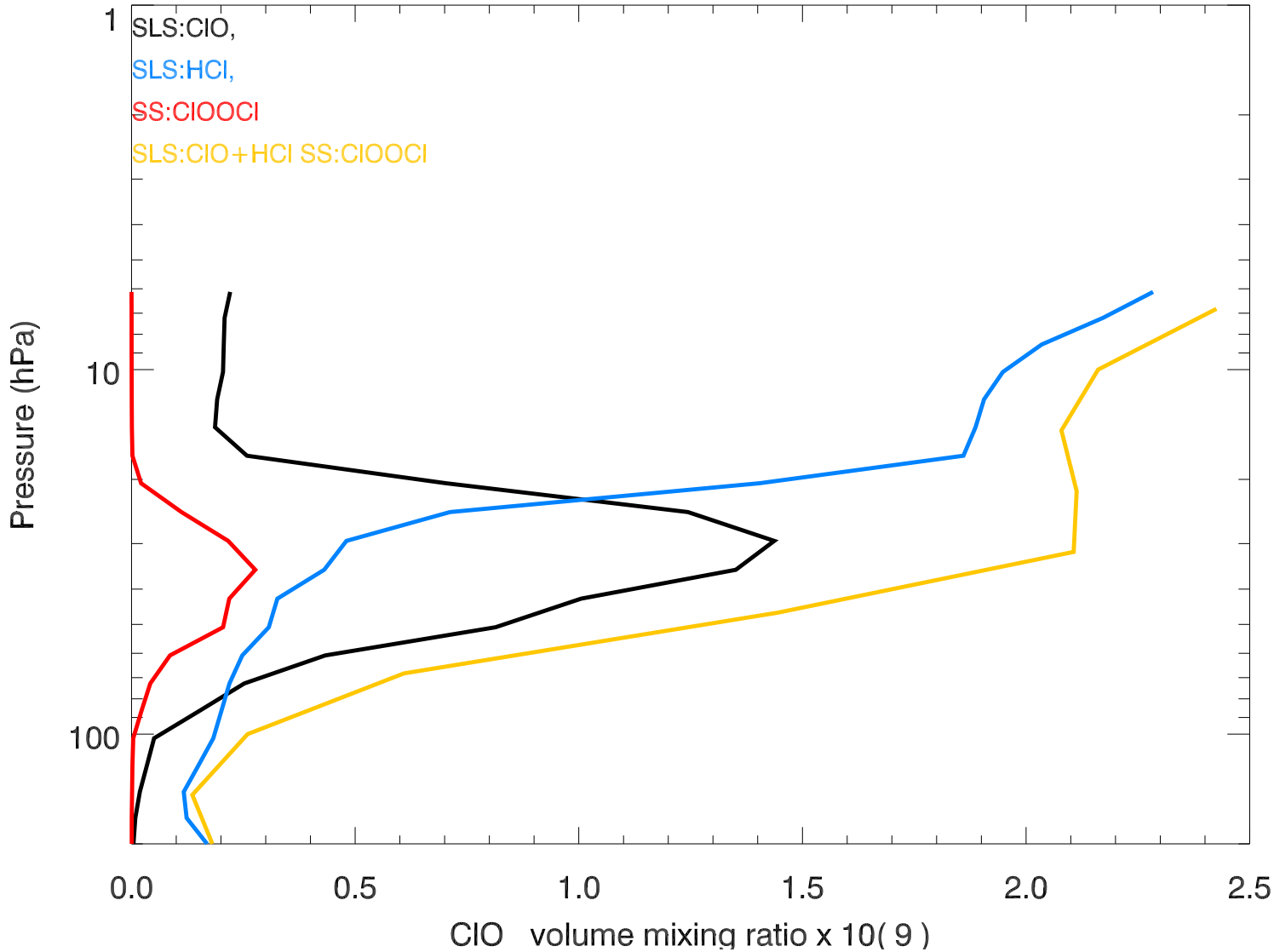
Cl Comparison

SLS:ClO+HCl MLS:ClO+HCl



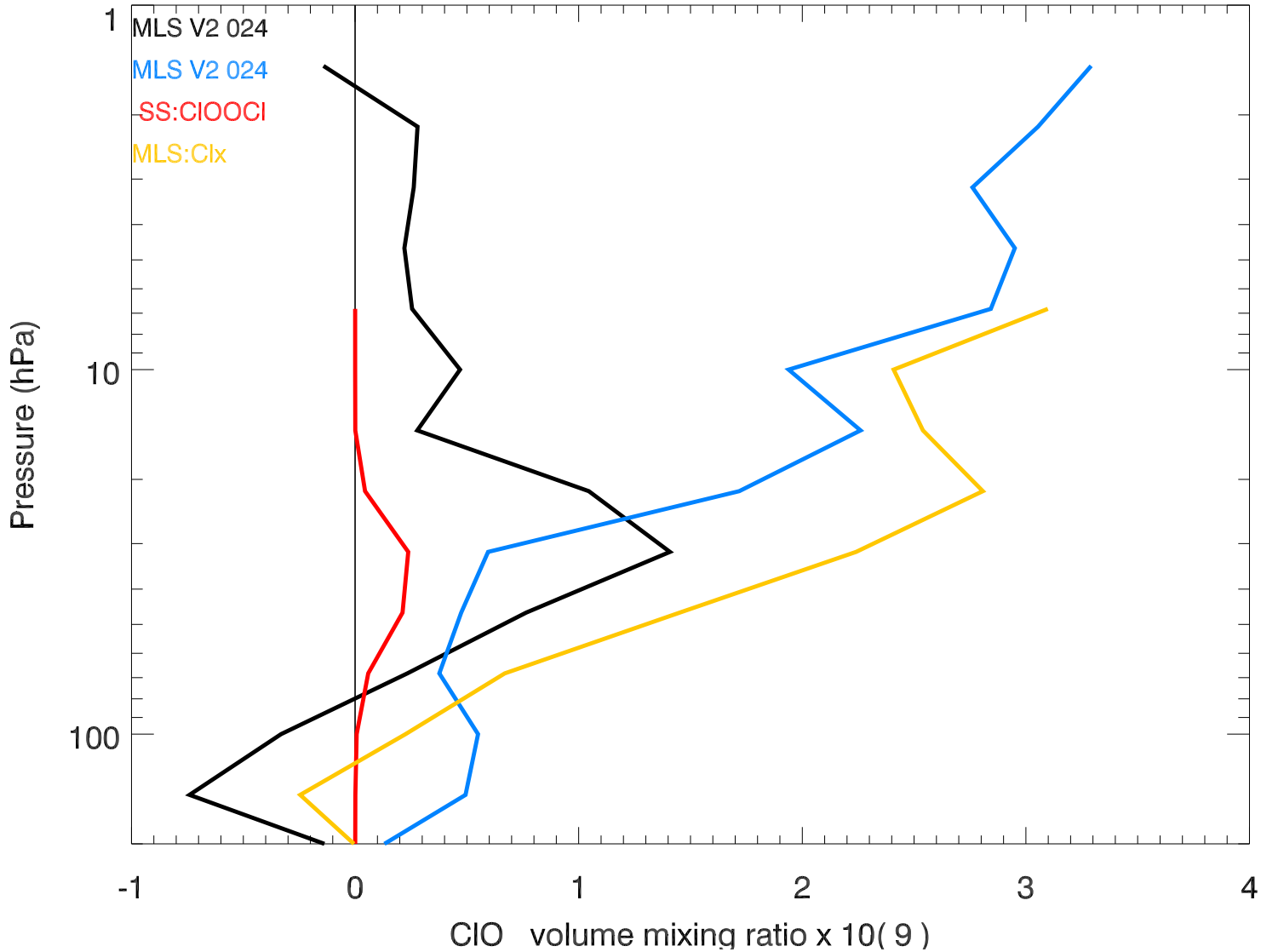
Clx

SLS:ClO, HCl, SS:ClOOCl(JPL 2002)



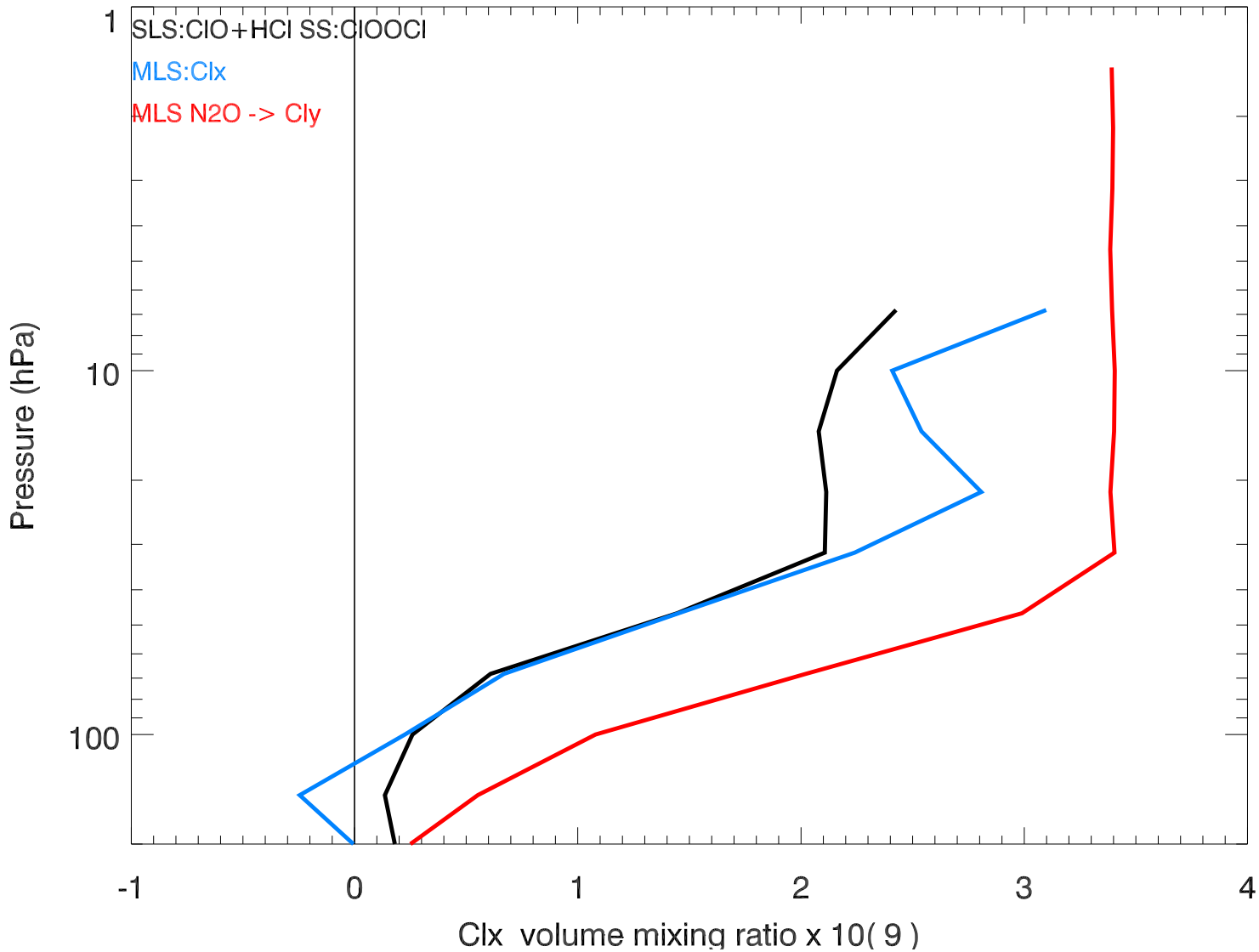
Clx Comparison

MLSV2024: HCL, ClO SS:ClOOCl(JPL 2002) MLS:Clx



Clx Comparison

SLS:Clx(JPL 2002) MLS:Clx MLS:N_2O->Cly



Summary

- Sucessful polar vortex balloon flight
- Observed 'activated' ClO levels, depleted HCl
- Agreement 'very good' with MLS ClO, O_3
- Some discrepancies to resolve; HCl ...

- Future
  - Ft. Sumner, NM Sept 2007 flight successful

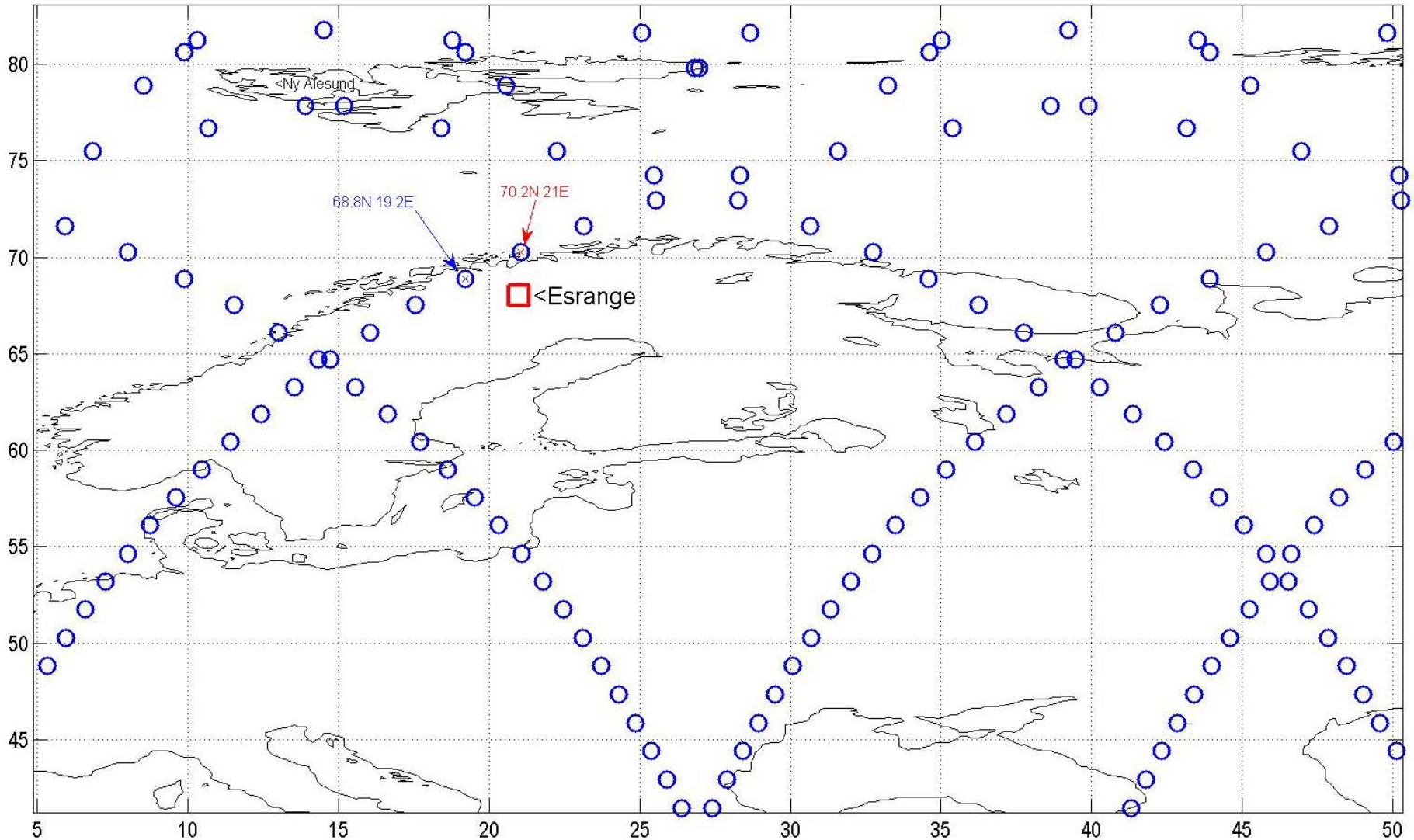
MkIV Balloon Flights – Esrange 2007

Voltaire Velazco, Jean-Francois Blavier, Geoff Toon, (JPL)

The JPL MkIV was launched deep into the vortex on Feb 6 and Feb 22. On both occasions the balloon burst (got too cold) upon reaching float. No occultation data were obtained on either flight.

A few spectra were obtained during the Feb 22 ascent (daytime launch). These have a lower sensitivity to trace gases than occultation spectra, but still allow the retrieval of strongly-absorbing gases over 25-34 km.

MkIV and MLS measurement locations for Feb 22, 2007



MkIV – MLS profile Comparisons

Six gases compared so far: H_2O , O_3, HCl, HNO_3, N_2O, CO.
MLS profiles are blue/red, as in the previous figure. MkIV are green.